

Chapter 27 – Problem Day

9. How long does it take electrons to get from a car battery to the starting motor? Assume the current is 300 A and the electrons travel through a copper wire with cross-sectional area 0.21 cm^2 and length 0.85 m. The number of charge carriers per unit volume is $8.49 \times 10^{28} \text{ m}^{-3}$.
21. A wire with a resistance of 6.0Ω is drawn out through a die so that its new length is three times its original length, but its volume remains constant. Find the resistance of the longer wire, assuming that the resistivity and density of the material are unchanged.
27. A potential difference of 3 nV is set up across a 2 cm length of copper wire ($\rho = 1.69 \times 10^{-8} \Omega \cdot \text{m}$) that has a radius of 2 mm. How much charge drifts through a cross section in 3 ms?
33. An electrical cable consists of 125 strands of fine wire, each having $2.65 \mu\Omega$ resistance. The same potential difference is applied between the ends of all the strands and results in a total current of 0.750 A. (a) What is the current in each strand? (b) What is the applied potential difference? (c) What is the resistance of the cable?
43. A 1250 W radiant heater is constructed to operate at 115 V. (a) What is the current in the heater when the unit is operating? (b) What is the resistance of the heating coil? (c) How much thermal energy is produced in 1.0 h?
51. A 100 W light bulb is plugged into a standard 120 V outlet. (a) How much does it cost per 31-day month to leave the light turned on continuously? Assume electrical energy costs US\$0.06/kW·h. (b) What is the resistance of the bulb? (c) What is the current in the bulb?
65. An 18.0 W device has 9.00 V across it. How much charge goes through the device in 4.00 h?
71. A 2.0 kW heater element from a dryer has a length of 80 cm. If a 10 cm section is removed, what power is used by the now shortened element at 120 V?

Chapter 27 Answers

- 9) 13 min
- 21) 54Ω
- 27) $3.35 \times 10^{-7} \text{ C}$
- 33a) $6.00 \times 10^{-3} \text{ C}$
- 33b) $1.59 \times 10^{-8} \text{ V}$
- 33c) $2.12 \times 10^{-8} \Omega$
- 43a) 10.9 A
- 43b) 10.6Ω
- 43c) $4.50 \times 10^6 \text{ J}$
- 51a) \$4.46
- 51b) 144Ω
- 51c) 0.833 A
- 65) $2.88 \times 10^4 \text{ C}$
- 71) 2.3 kW